MISSISSIPPI STATE UNIVERSITY EXTENSION

Best Management Practices for Plant Nutrient Management

Sustainably managing plant nutrients is key to a successful farm business and environmental stewardship. Crops grown in Mississippi offer unique challenges due to varying production systems on diverse soils in a warm, humid environment.

Best management practices (BMPs) are research-proven, achievable management options for use on a site-specific basis to minimize undesirable environmental effects. BMPs are selected based on soil types, slopes, climate, crops, nutrient management history, relevant cost-share programs, distance to surface water, and farm management goals and objectives. There is no "one-size-fits-all" option.

Landowners and managers should work with local USDA Natural Resources Conservation Service offices, county Soil and Water Conservation Districts, approved technical service providers, or other trusted advisers to develop nutrient and conservation management plans to maintain crops and the environment.

BMPs for Soil Fertility Management

The four Rs—using the **right amount** of the **right fertilizer** at the **right time** in the **right place**—are the foundation of nutrient management.

The **right amount** of fertilizer depends on whether the intended crop will benefit from added nutrients. This BMP begins with a well-designed soil testing program for phosphorus, potassium, selected other nutrients, and soil acidity using a reputable laboratory for analysis. Sometimes, zero phosphorus fertilizer is the answer for the current crop. Soils should be tested on a 2- to 3-year cycle. Calibrate and maintain equipment to ensure proper rates are applied.

When using animal byproducts (manures or poultry litter) for crop nutrition, get an analysis of the plant-available nutrients in the actual material that will be used whenever possible. Standardized animal byproduct table values are available, but accurate nutrient content of manure varies with animal type, diet, and management.

The **right fertilizer** for the situation requires knowing crop requirements and fertilizer properties. Refer to MSU Extension Publication 2500 Inorganic Fertilizers for Crop Production for information about available fertilizers and their properties. In addition, information on crop nutrient needs is available in MSU Extension Publication 2647 Nutrient Management Guidelines for Agronomic Crops Grown in Mississippi and other crop-specific publications available at https://extension.msstate.edu/publications.

Testing soils as a basis for nitrogen (N) fertilizer recommendations has not been standardized for Mississippi's warm, humid conditions. Nitrogen fertilizer properties that affect management include volatilization (conversion to a gaseous form) of nitrogen in surface-applied urea and urea-ammonium nitrate fertilizers. Loss increases when these fertilizers are used at temperatures above 65°F, in high humidity, or on soil surfaces with high organic matter or surface residues. MSU Extension nitrogen rate recommendations are available for individual crops in MSU Extension Publication 2647 Nutrient Management Guidelines for Agronomic Crops Grown in Mississippi.

Placing fertilizers in the **right place** also requires knowledge of fertilizer properties and calibrated, well-maintained equipment. Know the correct application width for the equipment, especially for spin spreaders, and the material being applied.

In some situations, placing fertilizers in a band near the row improves nutrient use efficiency. Incorporating animal manures into soil lessens the potential for nutrient movement. Avoid applying fertilizer materials near surface water bodies or field borders.

Applying at the **right time** for the crop increases use efficiency and decreases the potential for nutrient movement. Nitrogen use efficiency is best when applied close to the time of crop uptake. Applying nitrogen weeks before planting increases potential nitrogen loss from the field. Avoid fall applications of inorganic potash fertilizers if the soil cation exchange capacity (CEC) is less than 8 to avoid leaching loss.

Managing Plant Nutrients

- ☐ Use the USDA's Web Soil Survey to get accurate soil maps and relevant information for each field or management unit.
- ☐ Implement soil sampling for each field or management unit to determine baseline levels of phosphorus, potassium, other cations, and soil acidity. Refer to MSU Extension Publication 3858 Soil Testing for the Farmer for more information.
- ☐ Use reputable, accredited soil-testing laboratories for analysis and recommendations.
- ☐ Estimate realistic yield potential. A fair method is to average yields from the last 5 to 7 years.
- ☐ If possible, test animal manures for plant-available nutrients when used in crop production. Table values help for planning, but the accurate nutrient content of manure depends on several animal management factors.
- ☐ Estimate residual nutrients in the soil if manure was applied in the previous one to three growing seasons.
- ☐ If animal manures have been applied extensively in fields, environmental assessment tools such as the Phosphorus Index can evaluate nutrient transport chances in the landscape. These tools use site-specific soil erosion, soil tests, landscape position, and applied BMPs. Contact your local Natural Resources Conservation Service office for more information.
- ☐ Match nutrient application to available nutrient sources with estimated fertility needs.
- ☐ Keep and maintain records of nutrient applications.

BMPs to Manage Nutrient Movement in the Landscape

Plants require about 18 different nutrients to complete their life cycle. Carbon, hydrogen, and oxygen are obtained through photosynthesis; all other nutrients largely enter the plants via root uptake from the surrounding soil. Refer to MSU Extension Publication 2647 Nutrient Management Guidelines for Agronomic Crops Grown in Mississippi, Publication 3726 Micronutrients in Mississippi Soils and Plant Nutrition, and Publication 3727 Calcium and Magnesium in Mississippi Crop Production for more information on soil nutrient properties, including bioavailability and plant growth relationships.

The nutrients of most environmental interest are nitrogen and phosphorus. They may leach (move downward) through the soil to groundwater or move via overland flow (runoff) to adjacent surface waters. Nitrogen moves readily as it dissolves in water, and most forms do not attach readily to the soil. Conversely, phosphorus strongly attaches to soil particles and chiefly moves in the landscape when those particles move via erosion. A small portion of the phosphorus will dissolve and be transported to adjacent waters. The total capacity for nutrient movement is a function of the water flow rate.

BMPs for nutrients are intended to **avoid**, **control**, or **trap** their movement in agricultural landscapes. Appropriate BMPs are site-specific based on the field and farm. Nutrient management, as described above, is an avoiding BMP. For more information about BMPs to manage plant nutrients, refer to MSU Extension Publication 2647 Nutrient Management Guidelines for Agronomic Crops Grown in Mississippi.

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